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MODIFICATION OF FLOW PROPERTIES BY USING OF RUBBER PROCESSING ADDITIVES

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ABSTRACT: This article describes the utilization of rubber processing additives in rubber compounds for the applications in the tyre. It is known that rubber processing additives include a wide variety of chemicals. Every one of determinated groups by effect is specified by different chemical composition of products and with different chemical and physical behaviour in rubber compound. Due to their special effect, they were used to -improve the flow characteristics thus specifically improving the processing behaviour of compounds during extruding, calendering, moulding, etc. Experiments are focused on evaluation of mixing quality parameters for tyre tread compound. These additives reduce viscosity, promote dispersion, shorten mixing times and lower mixing temperatures and energy requirements. Peptizers promote the reduction of polymer molecular weight by chemical means thus increasing the efficiency of rubber mastication. Determinate the influence of peptizing agents in rubber mixtures, all tests were realised on Malaysian natural rubber SMR 20 without any addition compound additives.

KEY WORDS: rubber additives, flow properties, mixing quality

1. INTRODUCTION

Processing aid is chemical or substance which is added to rubber compound in small quantity (max. to 15 phr), ordinary to 6 phr improves its processing without any negativ influence of its physical-mechanical properties.
Multifunctional additives belong also between processing aids.
Multifunctional additives are new products enable a significantly more efficient compound preparation and facilitate the processing: preparing of compounds, calendering, injection moulding, extrusion and confectioning.
It is universal additive, which can work in rubber compound as a for example internal as well as external lubricant, so it helps to decrease viscosity values and to improve flowing properties.
Thanks to its presence in compound filler dispersantion is also improved. Multifunctional additive can also work as vulcanization activator.
The use of multifunctional additives in rubber compounds has the following functions:

- Reduced energy costs and less wastage during mixing and cooling of compounds
- Shorter processing time due to higher flowing properties
- Higher filling grades bring more cost reduction
- Less "reject" due to higher quality of extrusion and injection articles
- Higher building or green tack of semi-finished products

Applies multifunctional additive:

- Werbablend H250
  - brown pellets
  - Blend of aliphatic acid esters with modified phenolic polymers
  - Highly efficient! Can be mixed fast and uniformly. Improves efficiently and long-lastingly building, green tack and the homogeneity of the rubber compounds at the same time.

2. EXPERIMENTAL PARTS

It was evaluated influence of multifunctional additive Werbablend H250 as replacement for tackifying resins (Colophonium and Korezin) for processing properties of sidewall compound based on measured following values:

- energetic demandingness of sidewall compound mixing process
- Mooney viscosity $M_L(1+4)'/100°C$
- flow index: single-turn laboratory extruder Brabender 19/10 DW
  diameter of capilary 4mm
  by rotation speed 7, 15, 30, 45, 60 rot/min, T=100°C
- appearance of extruded profile:
  single-turn laboratory extruder Brabender 19/10 DW
  extrusion head Garvey type
  by rotation speed 10 and 45 rot/min, T=80°C
- vulcanization safety by T=120°C, 90 min.
- physical-mechanical properties
- reflexive elasticity [%]abrasive resistance [mm^3]

Formulations of test standard sidewall compound and sidewall compound with Werbablend H250 :

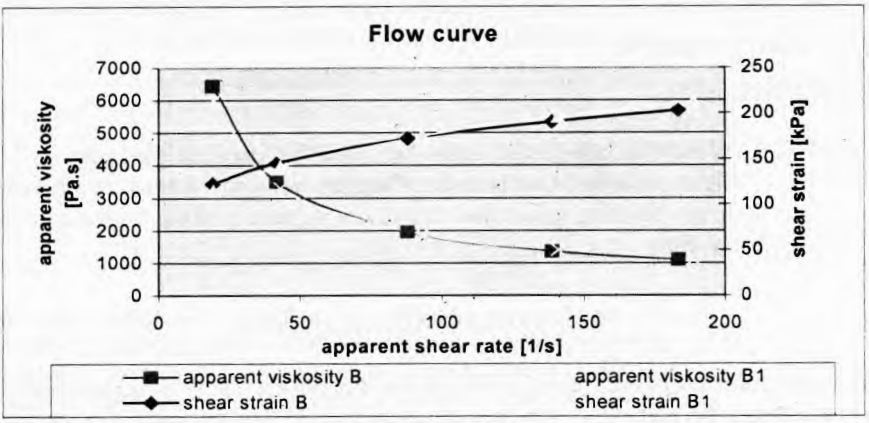
Tab.1: Formulation of test sidewall compound

	B	B1
	phr	
Batch (TSR-20, peptizer, ZnO, stearin, carbon black, oil) SKD	122	122
Colophonium	4,1	0
Korezin	1,8	0
Werbablend H250	0	4

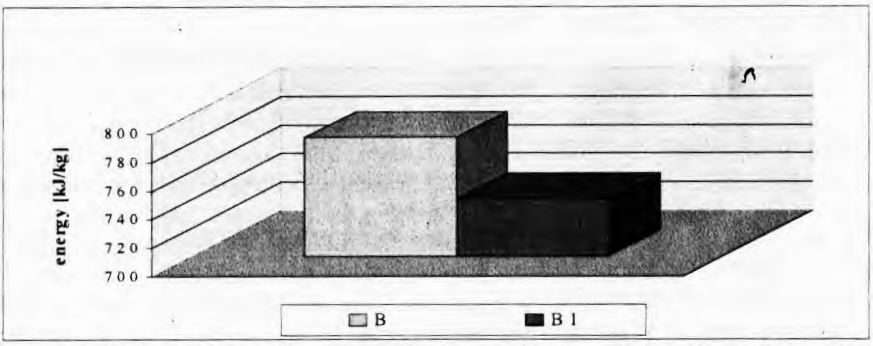
B – standard compound for sidewall prepared by two mixing steps.

B1 – sidewall compound consist of 4 phr Werbablend H250 which is replacing 4,1 phr Colophonium and 1,8 phr Korezin in compound. This compound was prepared by two mixing steps.

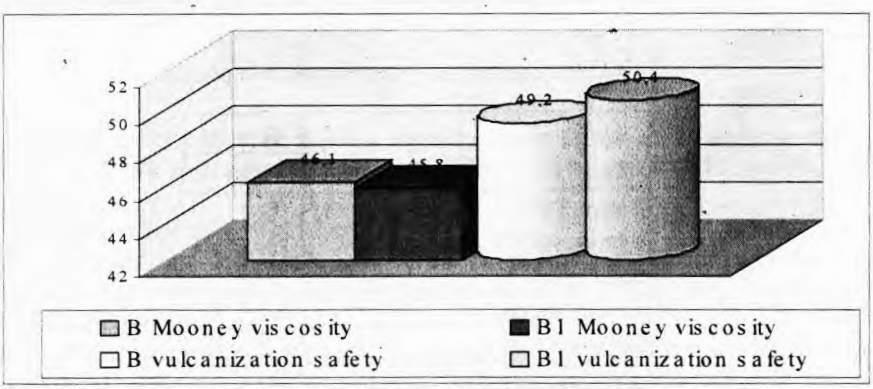
Werbablend H250 was added at the beginning of mixing together with natural rubber batch and SKD. The dosing was selected according to producer advice: WERBA-CHEM.



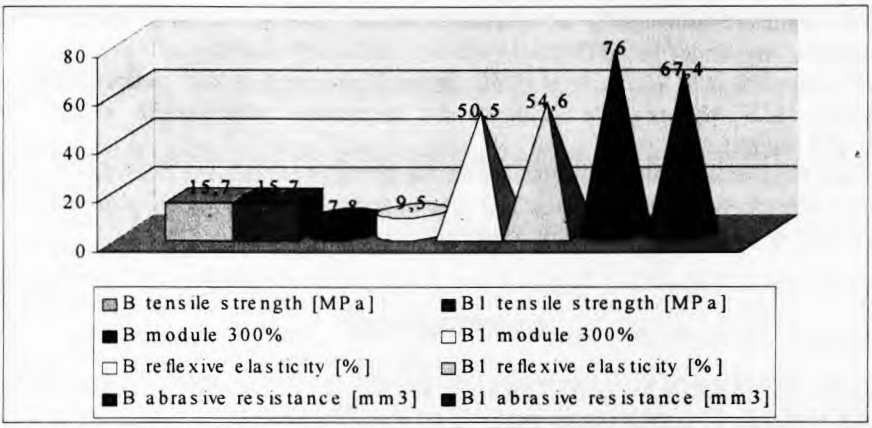
Graph 1: Flow curve of sidewall compound without and with Werbablend H250.



Graph 2: Energy of sidewall compound mixing without and with Werbablend H250.



Graph 3: Mooney viscosity and vulcanization safety sidewall compounds.



Graph 4: Tensile strength, module 300%, reflexive elasticity and abrasive resistance of sidewall compound without and with Werbablend H250.

Fig. 1: Sidewall compound with Colophonium and Korezin, 10 rot/min, T = 80°C

Fig. 2: Sidewall compound with Werbablend H250, 10 rot/min, T = 80°C

Fig. 3: Sidewall compound with Colophonium and Korezin, 45 rot/min, T = 80°C

Fig. 4: Sidewall compound with Werbablend H250, 45 rot/min, T = 80°C

3. CONCLUSIONS

Werbablend H250 in comparsion with Colophonium (4,1 phr) and Korezin (1,8 phr) decreases more the energy consumption by sidewall compound mixing and slightly decreases viscosity of this compound.

Compound flow index with multifunctional additives content determined by single-turn laboratory extruder Brabender 19/10 DW with worm length 10D, with compresion ratio 1:1, equiped with capilary with round intersection with diameter 4mm (SK-La-101-024) is higher in comparsion with Colophonium and Korezin content compound. Follow on we can say that Werbablend H250 improves flowing of tested sidewall compound.

We have evaluated appearance of extruded profile. The profile was extruded single-turn laboratory extruder Brabender 19/10 DW equiped with extrusion head Garvey type.

Sidewall compound with Werbablend H250 content has better look and sharper edges.

Werbablend H250 has positive influence for compound vulcanisation safety, though the difference is only slightly.

Concerning physical-mechanical properties tensile strength of standard sidewall compound is the same as tensile strength with Werbablend H250 content and module 300% has increased.

Values reflexive elasticity and abrasive resistance have increased.

4. REFERENCES

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